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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/049,615	02/21/2002	Hiroshi Yoshida	011362	2567

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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 10/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/049,615

Applicant(s)

YOSHIDA ET AL.

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 7/13/2004.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Terminal Disclaimer

1. The terminal disclaimer filed on 7/13/2004 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 6,527,858 has been reviewed and is NOT accepted.

The person who signed the terminal disclaimer is not recognized as an officer of the assignee, and he/she has not been established as being authorized to act on behalf of the assignee. See MPEP § 324.

2. An attorney or agent, not of record, is not authorized to sign a terminal disclaimer in the capacity as an attorney or agent acting in a representative capacity as provided by 37 CFR 1.34 (a). See 37 CFR 1.321(b) and/or (c).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schetzina (US 5,679,965) in view of White et al (US 6,291,085) and Applicants' Admitted Prior Art (Admission).

In a method of growing ZnO, Schetzina teaches a substrate is held between 300-900°C for monocrystalline growth of ZnO using MBE (col 19, ln 1-50), this reads on applicants' single crystal ZnO.

Schetzina does not teach a p-type dopant selected from the group consisting of C, N and oxides thereof.

In a method of making a p-type ZnO, White et al teaches doping a ZnO film with a p-type dopant, such as Nitrogen (col 4, ln 5-25). White et al also teaches the net acceptor concentration of between about 10^{18} and 10^{21} acceptors/cm³ and a resistivity of no more than 1 ohm-cm (col 5, ln 45-60). White et al also teaches MBE, MBE with laser ablation, CVD and MOCVD can be used to fabricate the ZnO layer (col 7, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Schetzina's single crystalline ZnO layer by doping with p-type dopant, as taught by White et al, because a p-type ZnO layer is useful as a light emitting diode and has a lower resistivity (col 1, ln 10-20 and col 2, ln 10-20).

The combination of Schetzina and White et al does not teach the p-type single crystal ZnO comprises 1 to 99 mol% manganese.

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Admission teaches to achieve a ferromagnetic state with a high ferromagnetic transition temperature by doping Mn into ZnO, it is required to heavily dope a hole (p-type carrier) having an interactional function for ferromagnetically uniform the spin in Mn doped into ZnO being a wide-gap semiconductor. Admission also teaches a single crystal ZnO doped with Mn having a high ferromagnetic transition temperature enables high density magnetic recording medium capable of transmitting larger amounts of information. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the heavily doped p-type ZnO single crystal taught by the combination of Schetzina and White et al with Admission's method of doping Mn into a ZnO crystal because a ZnO film doped with Mn can be used as a high-density magnetic recording medium.

The combination of Schetzina, White et al and Admission is silent to the pressure and partial pressure. Pressure and partial pressure of reactants are well known in the art to be result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schetzina, White et al and Admission by optimizing the pressure and partial pressure to obtain the claimed pressure and partial pressure by conducting routine experimentation of result effective variables (MPEP 2144.05).

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1-2 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Applicants Admitted Prior Art (Admission).

US 6,527,858 claims a p-type ZnO single crystal comprising a zinc oxide that contains a p-type dopant composed of nitrogen or carbon and an n-type dopant composed of any one or more elements selected from a group consisting of boron, aluminum, and gallium. US 6,527,858 also claims the hole concentration is 1×10^{17} holes/cm³ or more and the electric resistivity is lower than 100 ohm-cm.

US 6,527,858 does not claim a ferromagnetic p-type consisting of 1-99% manganese.

Admission teaches to achieve a ferromagnetic state with a high ferromagnetic transition temperature by doping Mn into ZnO, it is required to heavily dope a hole (p-type carrier) having an interactional function for ferromagnetically uniform the spin in Mn doped into ZnO being a wide-gap semiconductor. Admission also teaches a single crystal ZnO doped with Mn having a high ferromagnetic transition temperature enables high density magnetic recording medium capable of transmitting larger amounts of information. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the heavily doped p-type ZnO

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single crystal with Admission method of doping Mn into a ZnO crystal because a ZnO film doped with Mn can be used as a high-density magnetic recording medium.

The combination of US 6,527,858 and Admission does not teach the concentration of manganese is 1-99 mol%. Concentration is well known in the art to be a result effective variable. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858 and Admission by optimizing the amount of manganese to obtain the claimed concentration by conducting routine experimentation of a result effective variable (MPEP 2144.05). Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

The combination of US 6,527,858 and Admission teaches a hole concentration of 1×10^{17} holes/cm³ or more and the electric resistivity is lower than 100 ohm-cm. Overlapping ranges are held to be obvious (MPEP 2144.05).

7. Claims 3-4 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,527,858 in view of Applicants Admitted Prior Art (Admission), as applied to claims 1-2 above, and further in view of Schetzina (US 5,679,965).

The combination of US 6,527,858 and Admission teaches all of the limitations of claim 3, as discussed previously, except the operating parameters of a substrate held within a temperature range of 300-800°C in a vacuum atmosphere of about 10^{-8} Torr and the partial pressure of the reactants.

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In a method of growing ZnO, Schetzina teaches a substrate is held between 300-900°C for monocrystalline growth of ZnO using MBE (col 19, ln 1-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858 and Admission with Schetzina's teaching of a substrate temperature of 300-900°C to produce an expected result.

The combination of US 6,527,858, Admission and Schetzina is silent to the pressure and partial pressure. Pressure and partial pressure of reactants are well known in the art to be result effective variables. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,527,858, Admission and Schetzina by optimizing the pressure and partial pressure to obtain the claimed pressure and partial pressure by conducting routine experimentation of result effective variables (MPEP 2144.05).

Response to Arguments

8. Applicant's arguments filed 7/13/2004 have been fully considered but they are not persuasive.

Applicants' terminal disclaimer filed on 7/13/2004 to overcome the obviousness-type double patenting rejection over US 6,527,858 has been found to be improper; therefore the arguments directed to the improperly filed terminal disclaimer are not found persuasive.

9. Applicant's arguments with respect to claims 1-4 have been considered but are moot in view of the new ground(s) of rejection.

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Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Fuji (JP 07-288259) teaches a molecular beam epitaxy of a Group II-VI semiconductor using a chamber pressure of 10^{-7} - 10^{-9} Torr (English Abstract and [0008]).

Forbes et al (US 6,498,362) teaches a ferroelectric film comprising ZnO doped with manganese (Abstract).

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER
